WHAT IS CLAIMED IS:

1. A driver circuit for an ultrasonic transducer, comprising:

a current sense circuit coupled to detect a transducer load current;

a controller coupled to the current sense circuit and configured to perform a frequency sweep of a driver output to locate a resonance frequency corresponding to peak current;

a voltage-controlled oscillator (VCO) coupled to the controller and configured to generate an output signal oscillating at the resonance frequency; and

a pulse width modulator coupled to the VCO and configured to modulate an output current of the driver circuit.

2. The driver circuit of claim 1 further comprising a first switch and a second switch coupled to the pulse width modulator and configured to switch an amount of the output current in response to the VCO output signal.

3. The driver circuit of claim 2 further comprising an analog-to-digital converter coupled between the current sense circuit and the controller, and configured to convert an analog output signal of the current sense circuit into a digital signal.

4. The driver circuit of claim 3 further comprising a digital-to-analog converter coupled between the controller and the VCO, and configured to convert a digital controller output signal to an analog voltage signal.

5. The driver circuit of claim 1 wherein the current sense circuit comprises:

a current sense resistive element magnetically coupled to the transducer;

a low pass filter coupled to the current sense resistive element; and

a full-wave rectifier coupled to the low pass filter and configured to generate a DC signal representing the transducer load current.

6. The driver circuit of claim 5 further comprising a current transformer coupled between the current sense resistive element and a magnetic coil.

7. The driver circuit of claim 5 wherein the low pass filter comprises a fourth order active filter.

8. The driver circuit of claim 1 further comprising an alarm circuit coupled between the current sense circuit and the controller, and configured to disable the pulse width modulator when the load current reaches a predetermined threshold.

9. The driver circuit of claim 8 wherein the alarm circuit comprises a comparator having a first input coupled to an output of the current sense circuit and a second input coupled to a reference signal corresponding to the predetermined threshold.

10. The driver circuit of claim 2 wherein each of the first and second switches comprises a field effect transistor.

11. The driver circuit of claim 10 wherein the pulse width modulator is configured to generate a first pulse width modulated signal PWM1 coupled to a gate terminal of first field effect transistor switch, and a second pulse width modulated signal PWM2 coupled to a gate terminal of second field effect transistor switch, wherein the signals PWM1 and PWM2 are non-overlapping pulses.

12. The driver circuit of claim 11 wherein the pulse width modulator generates signal PWM1 at one of a rising or falling edge of the output signal of the VCO, and generates signal PWM2 at the other one of the rising or falling edge of the output signal of the VCO.

13. A method for driving an ultrasonic transducer, comprising:

(a) sweeping a transducer frequency profile to locate a peak load current;

(b) defining a reference frequency as the frequency corresponding to the peak current;

(c) adjusting an oscillation frequency of an oscillator to the reference frequency;

(d) controlling output transistor switches by pulse width modulated signals generated in response to the oscillator output to adjust transducer current; and

(e) periodically repeating steps (a) through (d) to dynamically adjust the reference frequency that controls the transducer current.

14. The method of claim 13 wherein the step of sweeping the transducer frequency profile comprises an initial round of multiple frequency sweeps with increasing granularity.

15. The method of claim 14 wherein the step of sweeping the transducer frequency profile comprises:

performing a first broad frequency sweep using a first frequency step to locate a first approximate peak frequency f1;

performing a second medium frequency sweep using a second frequency step that is smaller than the first frequency step, the second medium frequency sweep being centered around frequency f1 and yielding a peak frequency f2; and

performing a third fine frequency sweep using a third frequency step that is smaller than the second frequency step, the second third fine frequency sweep being centered around frequency f2 and yielding a peak frequency f3.

16. The method of claim 13 wherein the step of sweeping the transducer frequency profile comprises a mid-operation sweep centered around the reference frequency.

17. The method of claim 13 wherein the step of controlling output transistor switches comprises generating non-overlapping pulse-width modulated signals.

18. An ultrasonic system comprising:

an ultrasonic transducer; and

a driver circuit coupled to the ultrasonic transducer, wherein the driver circuit comprises a microprocessor controlled phase-locked loop that is configured to periodically sweep a frequency profile of the transducer to locate and lock onto a resonance frequency, and to control a current of the transducer by pulse width modulated current switches.

19. The ultrasonic system of claim 18 wherein the driver circuit comprises a current sensor magnetically coupled to the transducer and configured to detect transducer current.

20. The ultrasonic system of claim 19 wherein the driver circuit further comprises a voltage-controlled oscillator (VCO) coupled to the microprocessor and configured to generate an output signal oscillating at the resonance frequency in response to a control signal from the microprocessor.

21. The ultrasonic system of claim 20 wherein the driver circuit further comprises a pulse-width modulator coupled to the VCO and configured to generate non-overlapping pulse width modulated signals in response to the VCO output signal.

22. The ultrasonic system of claim 18 further comprising a container for receiving energy from the transducer, the container having a chamber for holding a liquid containing cells or viruses to be lysed, and the chamber having a least one wall providing an interface between the transducer and the contents of the chamber.

23. The ultrasonic system of claim 22 wherein the transducer is directly coupled to the chamber wall.

24. The ultrasonic system of claim 22 wherein the transducer is coupled to the chamber wall via a horn, the horn having a vibrating tip for deflecting the chamber wall.

25 . The method of claim 13, wherein the transducer is driven to lyse cells or viruses held in a container by coupling the transducer to a wall of the container and sonicating the chamber.

26. The method of claim 25, wherein the transducer is coupled to the wall of the sample container via a horn.

27. The method of claim 25 wherein the transducer is directly coupled to the sample container.